AGRICULTURAL NEWS LETTER

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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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CMU, Du Pont's latest development in chemical herbicides, is described below and in the accompanying reprint of an article which appeared in SCIENCE, the official publication of the American Association for the Advancement of Science, published at Washington, D. C.

This new weed and grass killer is non-flammable and non-corrosive. This year it is being recommended for industrial uses only -- around railroad track areas and trestle sites, arsenals, lumberyards, gasoline storage areas, and other locations where total removal of plant growth is desirable to eliminate fire hazards. It is not currently recommended for use on cropland. CMU is formulated as a wettable powder containing 80% 3-(p-chlorophenyl)-1,1-dimethylurea.

NEW TYPE CHEMICAL WEED KILLER
DEVELOPED BY DU PONT RESEARCH

CMU, a highly effective new chemical weed and grass killer, is being introduced for industrial weed control purposes only, while its potential agricultural uses continue under investigation.

This new product of research in Du Pont laboratories has been found to be particularly effective in places where it is desirable to destroy all vegetation.

So far not enough is known about the new chemical's effect on the soil for Du Pont to recommend its use in crop areas, but eventually it may be expected to find a useful place in agriculture.

CMU Extensively Field Tested

The new herbicide was released for industrial use only after extensive tests under field conditions during 1950 and 1951. In addition to Du Pont tests, it was evaluated by more than 150 investigators in every state of the union and the territories of Hawaii, Alaska, and Puerto Rico; also in Canada, Honduras, and Colombia.

CMU is marketed in 10 and 50 pound containers by the Grasselli Chemicals Department as Du Pont 80% CMU Weed Killer. In this form it is a wettable powder containing 80% of the chemical 3-(p-chlorophenyl)-1,1-dimethylurea as the active ingredient.

When used in a spray at rates of from 40 to 80 pounds to the acre, CMU will eliminate growths of mixed grasses and broadleaved weeds. Its killing action appears to start in the root system, and to work upwards to the leaves. Tips of leaves begin to die, and then there is a general discoloration of foliage. Plant growth then stops, and the plant dies, leaving only bare soil.

Principal Uses of CMU

Because it is highly effective and convenient to use, Du Pont recommends it for the control of weeds and grasses along railroad roadbeds and trestle locations, around power sub-stations, and manufacturing plant sites. Since it is not flammable, CMU can be used to eliminate growth which constitutes a fire hazard in lumber yards, around oil tank farms, arsenals, and telephone and telegraph poles.

CMU is not corrosive. Laboratory tests have shown its acute oral toxicity to be of a low order as far as warm-blooded animals are concerned. It is non-volatile, but since it is very destructive of vegetation, it must be used carefully to avoid drift of spray material to valuable plants or cropland. CMU

should not be applied by airplane, or used on cropland or fallow fields, or on lawns.

Weeds Controlled by CMU

The amount of CMU needed to control various weeds and grasses varies with soil type, rainfall, and other local conditions. In general, 20 to 40 pounds of Du Pont 80% CMU Weed Killer per acre have provided practical weed control for six months to a year.

Based on Du Pont research, the following dosages are recommended for railroad and industrial uses:

For control of annual and perennial weeds such as Bermuda grass, quack grass, crabgrass, foxtail, cheat, pigweed, ragweed, and cocklebur --- 20 to 40 pounds per acre.

For hard-to-kill weeds, such as established Johnson grass, or where longer control is sought, up to 80 pounds per acre should be applied.

Since CMU affects the roots of the grasses and weeds first, best results in spraying are obtained when the spray is directed at the ground, where it will be absorbed by the roots. It will work best when applied just before or during the rainy season, or when there is considerable moisture in the soil. In spraying, a minimum of 50 gallons of water per acre has been used, but volumes up to 200 gallons are preferred.

Agricultural Uses Being Investigated

Extensive investigations are being made into the duration of soil sterility produced by CMU in various types of soils. Tests are also being carried on to determine the value of CMU to control weeds in certain agricultural crops, when applied in light dosages at planting time. In this connection, Dr. Dale E. Wolf,

research biologist for the Du Pont Company, addressing scientists attending the eighth annual North Central Weed Control Conference at Oklahoma City last December, said preliminary tests indicate that, when CMU is applied lightly, it may, under certain conditions, select and eliminate harmful weeds without injuring certain farm crops in which the weeds appear.

"When CMU is applied at rates of from one-half to five pounds per acre as a pre-emergence treatment in crops, it has controlled weeds for periods of from two to six months," Dr. Wolf reported. He stated that it appears to have particular promise for the control of weeds in sugar cane, cotton, corn, asparagus, and carrots.

As mentioned earlier, use of CMU as a weed control in crops will not be recommended until further research has been completed to determine the persistence of the material in various types of soils and under various rainfall conditions.

(Two Du Pont research scientists, Harry C. Bucha and Dr. Charles W. Todd, described the new chemical, and results of greenhouse tests with it, in the November 9, 1951 issue of "Science" magazine. This article is reproduced on the next page with the permission of the editors.)

Reprinted from SCIENCE, November 9, 1951, Vol. 114, No. 2967, pages 493–494.

3-(*p*-Chlorophenyl)-1,1-Dimethylurea—A New Herbicide

H. C. Bucha and C. W. Todd[1]

Grasselli Chemicals and Chemical Departments, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware

In the course of a study dealing with materials having plant-regulating properties, 3-(*p*-chlorophenyl)-1,1-dimethylurea, a new chemical compound, has been synthesized and found to be very effective in killing many plant species. In greenhouse tests described in detail below, it has appeared particularly effective in killing both annual and perennial grasses.

TABLE 1

Plant	Spray cone (%)
Tomato	0.05
Johnson grass seedlings	0.5
Established Johnson grass	3.0
Bermuda grass	1.0
Quack grass	1.0
Nut grass	3.0

The initial effect generally is leaftip dieback, beginning on the older leaves. This is followed by progressive chlorosis and retardation of growth, ending in the death of the plant. Preliminary observations in field experiments suggest strongly that 3-(*p*-chlorophenyl)-1,1-dimethylurea acts readily through the root system and is translocated upward to the leaves.

3-(*p*-Chlorophenyl)-1,1-dimethylurea was synthesized by reaction of *p*-chlorophenyl isocyanate with dimethylamine. The product melts at 169.8°–170.4° C. After crystallization from methanol, it is obtained as thin rectangular prisms which melt at 170.5°–171.5° C. It is an essentially neutral, stable substance, insoluble in water, and only slightly or moderately soluble in most organic solvents. Its solubility in acetone is sufficient for greenhouse tests such as those described here.

Preliminary toxicity tests conducted by the Haskell Laboratory of Industrial Toxicology of this company indicate that the LD_{50} of 3-(*p*-chlorophenyl)-1,1-dimethylurea by oral administration to male rats is approximately 3,500 mg/kg of body weight.

Various concentrations of 3-(*p*-chlorophenyl)-1,1-dimethylurea have been sprayed on test plants in the greenhouse, as shown in Table 1.

In these experiments, all plants used for the work were grown in 4-in. clay pots. Tomato plants, grown from seed, and Johnson grass seedlings were sprayed when 6–7 weeks old. Bermuda grass, quack grass, and Johnson grass were established from root stocks. Nut grass was established from tubers. All these established grasses were sprayed approximately 3 months after planting.

In the case of tomato plants, first symptoms appeared 3 days after spraying. The plants were dead in 7–14 days. With Johnson grass seedlings, first reaction was noted in 5 days, and the plants were dead 14–28 days after spraying. In the case of established perennial grasses, the initial response was noted in 7–10 days. Both tops and roots were killed in 2–3 months.

TABLE 2

	Age of plant at time of treatment (days)	Percentage kill at cone of	
		0.1%	0.25%
Meadow fescue	20	0	100
Wheat	12	100	100
Timothy	20	99	100
Sudan grass	20	75	99
Rye grass	29	100	100
Harting grass	29	65	100
Orchard grass	25	100	100
Prairie brome	25	65	100
Meadow foxtail	29	100	100

In another series of greenhouse experiments, a wider range of grass seedlings was sprayed with two concentrations of 3-(*p*-chlorophenyl)-1,1-dimethylurea, as shown in Table 2. The percentage kill at these concentrations is also given.

The seedlings used in this experiment were grown in flats in the greenhouse, and ranged from 2 to 6 in. in height at the time they were sprayed. In the case of most of these seedling grasses, the first symptoms appeared in 2–3 days. The percentage kill shown in Table 2 was reached 2–3 weeks after treatment.

More detailed field investigations are still in progress to determine the effectiveness of 3-(*p*-chlorophenyl)-1,1-dimethylurea against a wide variety of annual and perennial weeds. Tests are also being conducted to determine the persistence of the compound when applied in various types of soils.

[1] Acknowledgment is made to L. E. Cowart, H. E. Cupery, R. S. Johnson, G. L. McCall, W. C. Miller, B. C. Pratt, N. E. Searle, T. C. Ryker, M. B. Weed, and D. E. Wolf for their assistance in these studies.

RETAIL SALES OF APPLES INCREASED WHEN BULK AND LARGE BAG OFFERED

Information on how to increase retail sales of apples was developed in a test involving purchases by 78,178 shoppers at four chain stores in central New York.

In general, here are the trends revealed:

Sales were low when apples were offered in bulk only. Sales were highest when the apples were offered in a combination of bulk and a six-pound bag.

The test, carried out in the fall of 1950, was described by Max E. Brunk and Bennett A. Dominick, Jr., of the Cornell University Agricultural Experiment Station at Ithaca, N. Y., in the October, 1951, issue of FARM RESEARCH, published at Geneva, N. Y.

How Test Was Conducted

Observers stationed in the stores recorded the purchases. Location of displays in the stores was the same for all tests.

To measure the habits of shoppers, a standard display was used as a basis of comparison. This consisted of a combination of apples in bulk and apples in four-pound cellophane bags. Sales from this display averaged 20.1 pounds per 100 customers.

Apples moved the slowest when they were offered in bulk only, priced in two-pound units -- the rate being 10.8 pounds sold per 100 customers. When the same apples were priced in four-pound units, sales rose to 12.3 pounds per 100 customers.

"This test," said the authors of the study, "was repeated several times with the same results. Stores commonly offer apples only in bulk, which results in greatly reduced sales." Sales were also low when the apples were offered in a combination display of bulk fruit, priced in two-pound units and two-pound cellophane bags. The average for this combination was 11.8 pounds per 100 customers.

Large-Sized Units Sell Best

When the fruit was offered only in four-pound cellophane bags -- with no bulk apples in the display -- sales rose to 18.7 pounds per 100 customers. This is slightly below the standard average, and FARM RESEARCH commented: "A few people apparently refused to buy apples then they could not purchase them in odd-sized quantities. Also the presence of bulk fruit may give the shopper more confidence in the prebagged product."

As the size of the containers increased, however, sales increased considerably. The average for a display offering a six-pound basket and four-pounds in bulk went up to 20.2 -- 0.1 above the standard average.

The average for a display offering apples in four-pound Polythene bags and bulk was 21.4 -- which was 1.4 higher than the standard average. A real increase in sales was noted when tests were made of six-pound Polythene bags in combination with sales in bulk -- the purchases jumping up to 28.1 pounds per 100 customers.

Results Confirm 1949 Findings

Messrs. Brunk and Dominick point out that different results may be obtained with different merchandising practices in different areas, or even in the same area at different times, but that in general the 1950 findings confirmed information obtained in a survey of 500 stores made in 1949.

"In this survey," they said, "it was found that pricing in three and four-pound units was the most common, but that those stores which priced in six and seven-pound units sold the largest quantity of apples per store. It would appear that common merchandising practices could be improved by selling apples in larger-sized units.....This study reveals rather conclusively that many stores try to sell apples in too small units. Since most other produce sells in small two and three-pound units, there is probably a tendency for grocers to offer all produce in comparable size or price units."

TOUGH NEW SYNTHETIC FILM BASE DEVELOPED AFTER LONG RESEARCH

An entirely new synthetic base for photographic film has been developed by Du Pont research. Preliminary tests show that it is several times tougher and has much greater dimensional stability than any of the present types of film base. It is classed as a safety base, and is less flammable than present safety bases. The Photo Products Department is currently producing it at its Parlin, N. J., laboratory.

Five years of research and an investment of more than one and a quarter million dollars have gone already into the development of this new film base, the company said. Decision as to large-scale production awaits the results of evaluation tests now being conducted in cooperation with the Motion Picture Research Council and others having special interest in the unique properties of the new material. If it meets all tests satisfactorily, more than two years will be needed to design and complete large-scale manufacturing facilities.

The new material, technically known as a polyester, is chemically related to "Dacron" polyester fiber, the newest of the Du Pont Company's synthetic textile fibers. Both are condensation polymers made from ethylene glycol and terephthalic acid. The base has twice the tear resistance of the standard acetate or nitrate base film, and can be run through a projector from three to four times as long before perforations show appreciable wear. Because of its toughness and greater stiffness, it is believed that polyester film may make it possible to reduce the thickness of motion picture film by at least 20 per cent, with a resulting greater footage per reel, and accompanying savings in processing and handling.

The following story, originally published in the November, 1951 issue of WESTERN GROWER and SHIPPER, published at Los Angeles, California, is reprinted here by permission of the editors.

INSECTICIDE MAKERS HAVE RESPONSIBILITY TO PUBLIC

BY R. M. ROBERTS
E. I. DU PONT DE NEMOURS & CO., INC.
WILMINGTON, DELAWARE

In 1950 more than 250 witnesses appeared at a series of hearings in Washington, D. C., and submitted some 9,000 pages of testimony and more than 1,300 exhibits.

The hearings were conducted by the Food and Drug Administration to establish tolerances for residues of pest control materials used in sprays and dusts on fruits and vegetables, and among the volumes of information submitted, one clear fact stood out:

> Without modern agricultural chemicals to control insect pests and plant diseases, the nation's food production requirements could never be met by American farmers!

ACCELERATION

Since the close of World War II, a rapid pace has been set in the development of agricultural chemicals. In 1950 alone, the number of experimental products being evaluated at our agricultural experiment stations approximated a procession of new compounds which might have been spread over a decade in pre-war days.

Today, with many chemicals to choose from, selection of compounds to be applied to food products poses a problem of vital importance to the entire population -- for we are all consumers!

REQUIREMENTS

Insecticides must be potent enough to kill insect pests they are meant to control. Fungicides must adequately protect crops from plant diseases. Yet they must be so formulated that the grower can use them effectively and at the same time present no hazard to consumers of the treated produce.

CONTROLS

Gone are the days when the indiscriminate sale of some questionable chemical was possible. Federal controls in this field, dating back to 1910,

were strengthened in 1947 with passage of the Federal Insecticide, Fungicide, and Rodenticide Act.

Today, to conform with regulations, a manufacturer must present a sound case, backed up by unquestionable experimental data, before he can obtain permission to label and sell agricultural pesticides.

TESTS AND TRIALS

From the time a promising compound is first synthesized in the laboratory, until it is available to the grower, it must pass through a great many hands. Greenhouse tests may first indicate just how likely to succeed this new product is. If it looks good, field trials under varying conditions and in widely scattered sections of the country may be the next step.

While these are in progress, the toxicologist is likely setting up his feeding trials with experimental animals. These will determine the hazards that may exist when a wide range of dietary levels are consumed.

UNBIASED JUDGES

If initial field trials prove successful, the next step may be the distribution of samples of this experimental material to some of the leading federal and state investigators in the country. These unbiased judges will treat test plots at experiment stations with a range of dosages of the new compound. Here it will be compared with competitive materials for the same crop uses.

IS IT TOXIC?

And as these tests are being conducted, the toxicological study continues. After the index of safety for the chemical, when consumed in various amounts over a period of time, has been determined, certain other information is needed to safeguard those who will handle this new material in quantity lots.

Is the new compound readily absorbed through the skin? Is it harmful if inhaled? What concentration must be present before toxic effects are observed? These questions must be answered!

RESIDUES

Also during this test period, samples of both foliage and fruit are being garnered from the experimental plots. Some are taken within an hour after the new chemical was applied at varying rates. Others will be from plants a week, two weeks, or a month after application. They must be analyzed to find out how rapidly residues from sprays or dusts disappear.

VARIATION

This residue question is more important than many growers may realize. For example, it takes a rather toxic chemical to effectively control mites. Yet an organic phosphorus compound known as EPN can be used safely because, even on

the fuzzy skin of peaches, less than one and a half parts-per-million will remain 30 days after the last of three applications. Thus, if spraying is discontinued far enough in advance of harvest so residues can be dissipated, valuable crops can be saved with no hazard to the consumer.

As an example of quite a different sort of insecticide, consider methoxychlor. Here is a product which effectively controls many insect pests but embodies such a low order of toxic hazard for warm-blooded animals that it may be safely used close enough to harvest time to prevent last-minute damage by these insects.

LABELS

Such physical and chemical characteristics which stamp these various new compounds must all be recognized and classified. Further, they must all be set forth on the label under which the chemical goes to market. For here, with clear statements of the latitude and limitations governing the use of the chemical, the manufacturer turns over to the grower his acquired "know-how" in handling the product. He also passes along the responsibility of using that product in the manner for which it was intended, that it may save crops without endangering anyone's health!

Through teamwork and cooperation, from the laboratory to the packing shed, agriculture and the chemical industry can improve both the yield and quality of crops -- increasing the grower's return on his investment and filling the nation's food basket with better products!

GRANTS AND FELLOWSHIPS TO HELP STOCK-PILE KNOWLEDGE ANNOUNCED

Award of 75 post-graduate fellowships to 47 universities, and grants-in-aid to 15 universities to "stock-pile" knowledge through the support of fundamental research, has been announced by the Du Pont Company. They are for the 1952-53 academic year.

An authorization of $510,000 was provided by the company for these and other awards. This is substantially higher than the appropriation of $405,400 for the 1951-52 academic year.

These grants are for unrestricted use in the field of fundamental chemical research. The Du Pont awards in recent years have been so successful in furthering this work that the company decided to raise the yearly contribution from $10,000 to $15,000 to each of the ten universities which received awards for the present academic year and to make new grants of $10,000 each to five others. The grants are guaranteed for two years.

Institutions Select Own Lines of Research

The company makes these grants to the universities without restrictions and the institutions themselves decide the lines of research they will follow after

receiving the grants. The only stipulation is that the funds must be used for fundamental research -- that is, work prosecuted for the advancement of basic scientific knowledge and not for specific commercial objectives. The company emphasized that there shall be complete freedom in the communication and publication of the results of the research supported by the grants.

Institutions which will receive the $15,000 grants each are: California Institute of Technology, Cornell University, Harvard University, University of Illinois, Massachusetts Institute of Technology, University of Minnesota, The Ohio State University, Princeton University, University of Wisconsin, and Yale University. Institutions which will receive the grants of $10,000 each for the first time are: University of California at Berkeley, University of California at Los Angeles, Columbia University, Northwestern University, and University of Michigan.

The company also continued its support of the Wallace Hume Carothers Research Professorship in Chemistry at Harvard University with a contribution of $15,000 for the academic year. This professorship, which was established during the past year, enables a different staff professor every year to devote his full time to research.

Also authorized was $20,000 for continuing the company's membership in the Institute for the Study of Metals, University of Chicago.

Program In Chemistry Originated In 1918

Granting of the post-graduate fellowships is a continuation of the company's plan, originated in 1918, to encourage students to undertake post-graduate work in chemistry. It has since been expanded to include other fields of science and engineering. It provides support for pre-doctoral training of students in institutions of higher learning.

It is expected that the program will help maintain the flow of technically trained men and women into teaching and research work at universities and into technical positions in industry.

The selection of candidates for fellowships and the choice of problems on which they are to work are, as in the past, left to the universities which receive the awards. Individuals are under no obligation with respect to employment after completing work under a Du Pont fellowship.

Each of the fellowships provides $1,400 for a single person or $2,100 for a married person, together with an award of $1,200 to the university, for the next academic year. In addition to the awards, the company will pay the tuition of the fellows, thus the entire award to each university will be available to support research and study.

How Fellowships Are Divided

Of the 75 post-graduate fellowships to be awarded, all of which are pre-doctoral, 45 are in chemistry, 15 in chemical engineering, five in mechanical engineering, four in physics, three in metallurgy, two in biochemistry, and one

in biology. Of these, one each in physics, metallurgy, and biochemistry is newly established. The others were awarded for the current academic year and are offered again for the 1952-53 year.

Awards of Fellowships in Chemistry

Post-graduate fellowships in chemistry were awarded to Brown University, California Institute of Technology, Carnegie Institute of Technology, Columbia University, Cornell University, Duke University, Harvard University, Iowa State College, The Johns Hopkins University, Massachusetts Institute of Technology, Northwestern University, The Ohio State University, Oregon State College, The Pennsylvania State College, Polytechnic Institute of Brooklyn, Princeton University, Purdue University, Rutgers University, Stanford University, State University of Iowa, Syracuse University, Washington University (St. Louis), Western Reserve University, Yale University, University of California at Berkeley, University of California at Los Angeles, University of Chicago, University of Colorado, University of Delaware, University of Illinois, University of Indiana, University of Kansas, University of Maryland, University of Michigan, University of Minnesota, University of Missouri, University of Nebraska, University of North Carolina, University of Notre Dame, University of Pennsylvania, University of Rochester, University of Texas, University of Virginia, University of Washington (Seattle), and University of Wisconsin.

Chemical Engineering and Other Awards

Post-graduate fellowships in chemical engineering were awarded to Carnegie Institute of Technology, Columbia University, Cornell University, Massachusetts Institute of Technology, The Ohio State University, Princeton University, Yale University, University of Delaware, University of Illinois, University of Michigan, University of Minnesota, University of Pennsylvania, University of Tennessee, University of Texas, and University of Wisconsin.

Fellowships in mechanical engineering were awarded to Columbia University, Lehigh University, Massachusetts Institute of Technology, The Pennsylvania State College, and Purdue University.

Fellowships in physics were awarded to the Massachusetts Institute of Technology (new), The Ohio State University, University of Virginia, and Yale University.

Fellowships in metallurgy were awarded to Carnegie Institute of Technology, Lehigh University, and The Ohio State University (new).

Fellowships in biochemistry were awarded to the University of California at Berkeley (new) and the University of Wisconsin. One in biology was awarded to the California Institute of Technology.

RADIOACTIVE ISOTOPES WIDELY USED IN AGRICULTURAL RESEARCH

Radioactive isotopes as a tool of agricultural research were in use in 30 of the 48 states at the end of 1951, according to the Agricultural Research Administration of the United States Department of Agriculture.

How the "tracer technique" works was recently described in simple terms by Dr. Clifford M. Hardin, of Michigan State College, in a talk at the last annual National Farm Chemurgic Council Conference, held at Cincinnati, Ohio, in April, 1951. He said:

"Interest in atomic energy has brought with it a side-line activity which is proving to be of great importance to research workers in agriculture. For example, it is now possible to add radioactive phosphorus in minute quantities to fertilizer. Radioactive phosphorus behaves chemically just like ordinary phosphorus. By adding a small amount to fertilizer which is applied to the soil, it is possible then by use of a Geiger counter to follow the course of that particular fertilizer through the roots, stems and leaves of the plant, or if the fertilizer is lost through leaching, this also will show up.....

"More recently we have received a grant of funds from the Atomic Energy Commission to study the feeding of fruit trees and other plants through their foliage. Again the tracer technique is being used. For example, the nutrient can be sprayed on the leaves, following which samples of the tissue from various parts of the plant can be monitored with a Geiger counter to determine the speed and extent of absorption of the particular nutrient."

DETASSELING NO LONGER NECESSARY IN NEW PROCESS FOR MAKING HYBRID CORN

A new process for producing hybrid seed corn, which makes the laborious chore of detasseling unnecessary, has been developed by two New England scientists.

This has been done by the development of pollen sterile lines of corn -- corn plants which produce no pollen on their tassels.

The two scientists who developed the non-detasseling process are Dr. Donald F. Jones, head of the Genetics Department at the Connecticut Agricultural Experiment Station, at New Haven, and Dr. Paul C. Mangelsdorf of Harvard University and formerly on the Connecticut Station staff. They described the new process in a Connecticut Station bulletin entitled "The Production of Hybrid Seed Corn Without Detasseling," published in September, 1951.

Dr. Jones 34 years ago developed the double cross method of producing hybrid corn seed. He and Dr. Mangelsdorf, working sometimes jointly and sometimes independently, have in the past 30 years been seeking a method which would avoid the necessity of detasseling. The method described in the bulletin, they said, "has finally proved successful.....at least in part."

How Seed Is Produced By Old Method

Hybrid seed results from crossing corn plants of different types. These parent plants are grown side by side in large, isolated crossing fields and are pollinated by the wind. Only the pollen from the male parent, however, can be allowed to disperse itself on to the seed-producing parts of the female corn plant. If pollen from the female parent itself spreads onto its own seed parts, the resulting seed will not be true to type. It therefore becomes necessary to pull out the tassels from the female plant before any pollen is shed by them.

"Tassel removal on a scale sufficient to produce the eight million bushels of hybrid seed needed to plant some 65 million acres of corn annually is an operation of considerable magnitude," the authors explained. "Each summer the hybrid seed corn industry must find and train thousands of casual laborers for this purpose. One seed firm alone employs more than 20,000 laborers during the tassel-pulling season. It has been estimated that on the peak day of the season some 125,000 persons in the United States are engaged in removing tassels from corn plants. When there are labor shortages, or when rainy weather prevails during the detasseling season, the producer of hybrid seed corn has a serious problem on his hands, and the quality of his product may suffer from unavoidable self-pollination."

Various ways of rendering detasseling unnecessary were tried, including the destruction of the tassels by chemicals or by heat treatment, without success. The experiments then took another direction. "There are many forms of genetic male sterility which effectively prevent pollen production and investigations on employing these as a substitute for detasseling began quite early," the bulletin relates.

Sterile Inbreds Used in Experiments

The New England scientists finally directed their attention to forms of cytoplasmic male sterility -- plants which produce no pollen on their tassels, but whose seed-making parts are normal. M. M. Rhoades in the Journal of Genetics in 1933 had described a condition of pollen sterility found in a Peruvian variety, and later similar types were found in Texas, Argentina, Brazil, and at the Agricultural Research Center of the United States Department of Agriculture at Beltsville, Maryland.

"The original cytoplasmic sterility described by Rhoades appears to have been lost. Seeds from the Texas, Maryland, and Brazilian types of sterility were obtained and many of the standard inbreds widely used as seed parents have been converted to the cytoplasmic sterile condition by crossing and backcrossing," the bulletin states.

"A similar type of cytoplasmic sterility has also been found in flax, onions, carrots and sugar beets, as well as a number of species used primarily for genetic investigations...," This path, however, was not an easy one. "Employing cytoplasmic sterility in plants grown, not for their vegetative parts, but for their seed, presents additional problems. A field of male sterile corn, for example, would also be functionally seed sterile, producing little or no grain. At first there seemed to be no practicable solution to this critical problem....."

Paired Progeny Selection Key to Problem

Eventually the problem was solved by working with varieties which had maintained a highly sterile condition for several generations, and then finding a genetic process to restore pollen fertility in the final crop, so that the farmer will get full ears of corn. Here is how the work is described:

"It was soon realized that the fertile plants, whose pollen is used to maintain the sterile plants by backcrossing, must be selected for the complete absence of any of these pollen restoring genes. This led to a method of paired progeny selection in which the individual plant used to supply the pollen for the backcross is also self-fertilized and grown alongside the sterile progeny from a single backcrossed plant. If this backcrossed progeny is completely sterile and desirable in other respects, both the sterile progeny and its fertile counterpart are selected for further propagation. If the sterile progeny shows any undesirable characteristics, both members of the pair are discarded.

"This paired progeny selection is the key to the successful use of cytoplasmic sterility. By the use of this method, together with the best available sterilizer stocks, it has been possible to convert practically all of the standard inbreds now widely used as seed parents in single crosses." To convert an inbred to the sterile condition, from three to five backcrosses are adequate, the bulletin states. The authors describe an unusul case, as follows:

"A late southwestern sterile dent variety which, in Connecticut, grows more than 10 feet tall and silks in September, has been converted to a sterile early sweet corn inbred less than three feet high, silking about the middle of

July. The sterile and fertile versions of this inbred are identical in all respects except that one produces abundant pollen, the other none at all. This amazing transformation took place in three generations."

How Pollen Fertility Is Restored

Two different ways of restoring pollen fertility are described:

"The first involves mixing a portion of normal fertile seed with sterile seed... The second... is by incorporating pollen restoring chromogenes in one or both of the pollen parent inbreds. This is more difficult to do as these genes must be transferred, after crossing over has freed them from any undesirable genes to which they may be closely linked."

The Connecticut Station said that almost any standard inbred or hybrid can be made pollen sterile by crossing and backcrossing. Several commercial hybrid seed corn producers tried the process on some 1,000 acres of seed fields in 1951, a station news release said.

The grower of hybrid corn, as well as the seed producer, receives some advantages from the new method, according to Dr. Jones and Dr. Mangelsdorf. There is considerable indication that plants freed of their pollen-producing function divert their energies to bigger stalk and ear growth. Preliminary yield tests show that the crop from sterile plants may be larger than that from their fertile counterparts. Also, the saving in labor by the seed producer may be passed on to the seed buyer with lower prices. Since hand-detasseling inevitably results in some damage to the plants, and some tassels are always skipped, the new process avoids these disadvantages also.

Dr. Jones has been a member of the Connecticut Station staff since 1915. Known the world over by practical farmers for his work with hybrid corn, he is equally renowned among his scientific colleagues for his contributions to genetic theory. He is the author of two books, "Genetics in Plant and Animal Improvement" and "Selective Fertilization," and is co-author of "Inbreeding and Outbreeding" and "Biology in Human Affairs."

UNUSUALLY TOUGH TRANSPARENT FILM DEVELOPED AFTER YEARS OF RESEARCH

An entirely new film with unusual strength, heat resistance, and insulating qualities, has been developed by the Du Pont Company through one of its fundamental research programs. Trade-marked "Mylar," it is a polyester film, similar in appearance to cellophane, but with distinct properties which appear to make it suitable for a series of new industrial uses.

It is being produced experimentally by Du Pont's Film Department on semi-works equipment in the company's Yerkes Research Laboratory in Buffalo, N. Y. While the film is being evaluated in a number of industrial fields, it is expected to be several years before it is generally available commercially, and even longer before its full possibilities can be developed. Only limited quantities can be made with present equipment.

Studies indicate it will find major uses for which cellophane and other commercial films are not suitable. The most promising immediate field appears to be electrical insulation. After additional research and development, "Mylar" is likely to go into the industrial tape field to widen the use of film-based tapes. It is also expected to be combined in laminations with other materials. Additional uses, which may be years away, include packaging, collapsible tubes, and lightweight storm windows.

New Film Has Great Strength

"Mylar" polyester film is a sparkling, transparent, colorless film which is tough and durable. It retains its flexibility at very low temperatures at which other films become brittle. It has high dimensional stability under heat and humidity changes, and it has good resistance to attack by chemicals.

Besides having most of the best properties of other commercial films, "Mylar" has several unique properties. One is high strength, from two to eight times that of other commercial films. This makes possible thinner gauges, as fine as a quarter of one-thousandth of an inch, or about one-third as thick as the thinnest commercial films produced by Du Pont in the past.

A second property is its ability to retain dimensions and properties through a wide range of heat and cold. A third, and rather technical, property, is intermediate electrical polarity. This permits "Mylar" to store electrical energy, a requirement for use in condensers. Also, it has high dielectric strength, or insulating power, without excessive power loss, properties required for conductor insulation.

New Material Resists Heat

It is the combination of properties which makes "Mylar" polyester film appear attractive. For example, insulation for electric motors requires mechanical strength, long-term resistance to heat, chemical inertness, and high dielectric strength -- all of which the film has. Tests indicate that, for this use, "Mylar"

is superior to all existing materials except mica, which is fragile, high-priced, and in short supply.

Similarly, it may be used as insulation in capacitors or condensers. "Mylar" meets the requirements of high dielectric strength, thinness without fragility, and reasonably high dielectric constant. In this field, it may be used in telephones, radios, fluorescent light starters, electronic devices, and the like.

"Mylar" now sells for $3 to $4 a pound, depending on thickness. Reduction in price must await large-scale production with its consequent reduction of costs. In course of time, however, lower prices may be expected. When Du Pont started to make cellophane in 1924, the average selling price was $2.65 a pound, and today, with an improved product, it is about 57 cents a pound.

"Mylar" is a condensation polymer obtained from ethylene glycol and terephthalic acid. Thus, it is chemically similar to Du Pont's newest textile fiber, "Dacron" polyester fiber. "Dacron" is spun, whereas "Mylar" is cast in continuous sheets. It is also chemically similar to Du Pont's recently announced polyester base for photographic film of superior toughness.

Product Result of Lengthy Research

Groundwork for the development of "Mylar" polyester film was laid by the late Dr. Wallace H. Carothers, famed Du Pont research chemist, in his fundamental research work which led to nylon. However, "Mylar" is not chemically related to nylon.

Polyesters were among the first of the condensation polymers investigated by Dr. Carothers; but rather than continue this line he decided to devote his efforts to polyamides -- a course which led to nylon.

British research chemists, after studying his published works, undertook further study of polyesters. Their work led to development of a polyester fiber now sold in England under the trade-mark "Terylene." Independently, Du Pont researchers had undertaken a search for other useful condensation polymers expanding the early work of Dr. Carothers. Later, Du Pont learned of the British research and negotiated the purchase of patent rights for the specific polymer selected for development.

Further research by Du Pont resulted first in "Dacron" polyester fiber, and work by Du Pont scientists in somewhat different directions produced the photographic film base and "Mylar" polyester film. Research expenditures of more than $3 million were required to develop the polymer for film use and to develop the process and equipment for production of "Mylar." Further applied research to develop the full potentialities of all three products is continuing and is expected to go on for many years.

CHEMICAL BRUSH CONTROL ON PUBLIC PROPERTY DISCUSSED

BOSTON -- Most efficient ways of using new chemical tools to control weeds and brush on public property were pointed out here recently by W. I. Boyd, Du Pont Company representative, addressing a meeting of the Massachusetts Tree Wardens' and Foresters' Association.

Five modern chemicals, ranging from soil sterilants to foliage sprays to kill heavy brush, were listed by Mr. Boyd as tools which may conserve time, labor, and public funds in keeping roadsides, school property, park areas, and grounds around public buildings free of undesirable growth. No one of these compounds, Mr. Boyd declared, will serve all needs in the weed and brush control field. Each has "major advantages for certain jobs and major disadvantages for certain others."

Chemicals for this purpose, listed in the order in which they first were introduced to the public, were:

(1) "Ammate" weed killer, particularly well known for its ability to kill poison ivy; a non-selective material which is outstanding as a foliage spray to kill a wide range of brush and tree species.

(2) 2,4-D, a selective chemical to kill broad-leaf weeds in narrow-leaf crops; particularly suited to lawn weed control and treatment of certain easy-to-kill brush.

(3) 2,4,5-T, a chemical cousin of 2,4-D, preferred where brambles and certain varieties of brush are the specific problems.

(4) TCA, especially effective against certain grass-type weeds.

(5) CMU, recommended where all growth must be controlled for the elimination of fire hazards.

IN THIS ISSUE

CMU Weed Killer Introduced for Industry 19
Reprint of SCIENCE Magazine Article (facing page 22
How Retail Sales of Apples Were Increased 23
New Synthetic Film Base Developed 24
Responsibility of Insecticide Manufacturers to Public 25
Grants-in-Aid and Fellowships Announced 27
Radioactive Isotopes Widely Used in Agriculture 30
Production of Hybrid Corn Seed Without Detasseling 31
"Mylar" Polyester Film Introduced 34
Chemical Brush Control on Public Property 36

150th Anniversary

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